Review Paper on Traffic Reduce System Using Hydraulic Footpath

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Abstract- *Traffic congestion has been one of the major issues that most metropolises are facing in spite of measures being taken to mitigate and reduce it. In the recent past, traffic congestion has emerged as one of the main challenges for engineers, planners and policy makers in urban areas. Modern social and economic structures, shaped by car-oriented urban development and rapid growth in vehicle ownership, have established congestion as an inescapable reality of urban life. Traffic congestion can generally be defined as excess of demand for road travel. Many professionals and organizations have defined congestion in different ways based on variety of criteria.*

On sinhgad road, traffic is inherently chaotic and noisy. Traffic congestion is like blockage in a city which is very undesirable. Aggravation in traffic congestion reduces efficiency of road Identification of magnitude of traffic congestion is an essential requirement for defining the congestion and finding appropriate measure. To overcome this, various means and ways are available which are not commonly disclosed. Documentation and data analysis for giving appropriate solution is the main motto of this project. The project deals with the wise application of the various fields in Civil Engineering viz. Transportation, Structural and Project Management. The optimized solutions for suffocated Sinhgad Road and civilian around the area will be studied for the same by using appropriate advanced technologies.

So, here we adopted a mechanism which minimizes traffic problems and that mechanism is called hydraulic machine. Hydraulic machine is the mechanisms which lift the things up and down at a particular height. Our purpose is to create a mechanism which lifts the footpath at signalized intersection up and down when there is more traffic at signalized intersection. We studied about the various congested signalized intersection areas and then select sinhgad road for our study. We collected the peak hour traffic data using manual count survey method and categorized the vehicles into different classes. Calculate the queue length at sinhgad road using normal footpath and again calculate the queue length for same traffic data by using hydraulic footpath. On comparing the reduction of queue length percentage, we observed that hydraulic footpath is more preferable than the normal footpath for congested traffic at signalized intersection, because it reduce approximate 60% queue length. Also, hydraulic footpath gives extra space at signalized intersection and it helps to increase service volume.

Keywords- Traffic congestion, Traffic Reduced System (TRS), Hydraulic Footpath, Hydraulic Jack, sinhgad Road, etc.

I. INTRODUCTION

1.1 General Introduction

The population on sinhgad road is tremendous. The increase in personalized vehicles coupled with slow growth in the PMPML fleet has reduced the share of public transportation trips. The three wheelers are also a big chaos creating equipment on road. The road width of sinhgad road varies tremendously in between 30m to 50m. the illegal constructions due to unplanned development and lack of authorities to take control are adding to the mess. Cycle tracks and footpath that are present on some length of the road are occupied by small vendors. Hence the pedestrian and cycle traffic become part of the main road. New developments are in progress in newly added part of the villages. Thus, heavy trucks, cranes etc. have also started to take this route. Increase in the traffic volume due to various reasons such as rapid growth on both sides on sinhgad roads, rapid increase in population, aleatory construction, inefficient public transport is causing major traffic congestion on sinhgad road. This project defines the problems, examines the problems closely and proposes solutions to dilute these problems.

The hydraulic jack is a device used for lifting heavy loads by the application or applying of much smaller force. It is based on Pascal's law, which states that intensity of pressure is transmitted equally in all directions through a mass of fluid at rest. Hydraulic jacks are devices that have countless applications. This type of jack is used in the automotive industry to lift cars above ground level so they can be tooled. Many tools in the construction industry utilize hydraulic jacks to complete tasks.

1.2 Need of study

We observed that vehicular traffic is very high at sinhgad road and queues are formed in peak hours so, that minimization of queue is the demand. In incidental and accidental situation there is no alternate way to divert the traffic from current road to other road.

1.3 Hydraulic jack system in footpath

Every common people faced traffic congestion problem every day in their daily life and because of this problem everybody regularly fails to reach at their destination like offices, schools and colleges etc. but still physically fit and mentally stable people can wait for few minutes or may be for the couple of hours but emergency vehicles would not be able to wait until and unless traffic gets cleared, because they have the responsibility to save lives of those people who are physically ill and may be stuck in trouble. For minimizing the traffic in case of unstable circumstances and giving a proper way or path to emergency vehicles we have introduced new concept of hydraulic jack system installed in footpath to control upward and downward movement of footpath surface. In case of any emergency, area of footpath can be used as same as road surface for just temporary time and when the emergency vehicle passed out easily from footpath then with the help of hydraulic jack, footpath will get at its original position.

1.4Working Principle

The working principle of a hydraulic jack may be explained with the help of figure. Consider a ram and plunger, operating in two cylinders of different diameters, which are interconnected at the bottom, through a chamber, which is filled with some liquid.

Let,
F = External Force Applied
P = Pressure Created
D = Distance Moved
V = Volume of Water
A = Cross-Section Area

Solution :-

V1 = A1V1 (Input force) ----1
V2 = A2V2 (Output force) ----2

Now we can say,

A1D1 = A2D2

Calculate work (IN) and work (OUT)
Work = force x displacement
W(IN) = W(OUT)
F1D1 = F2D2
F1D1 ---- (a)
F2D2 ---- (b)

Therefore, calculate D1 & D2 from eq. 1 & 2
V1 = A1D1 ----1
D1 = V1/A1
V2 = A2D2 ----2
D2 = V2/A2

Put value of D1 & D2 in eq. (a) & (b)
F1D1 ---- (a)
F1 x V1/A1
F2D2 ---- (b)
F2 x V2/A2
Therefore,
F1 x V1/A1 = F2 x V2/A2
↓

Force / Area = Pressure = P1 & P2
P1V1 = P2V2
P1 = P2

It means the whatever amount of force we willapply on 1st point; it will create pressure & it will give same amount of force in the form of pressure on 2nd point with proper pressure & it also means that if we will take any incompressible liquid, apply external force create pressure & equally distribute or apply on every single drop of liquid & gives required pressure to lift the footpath.

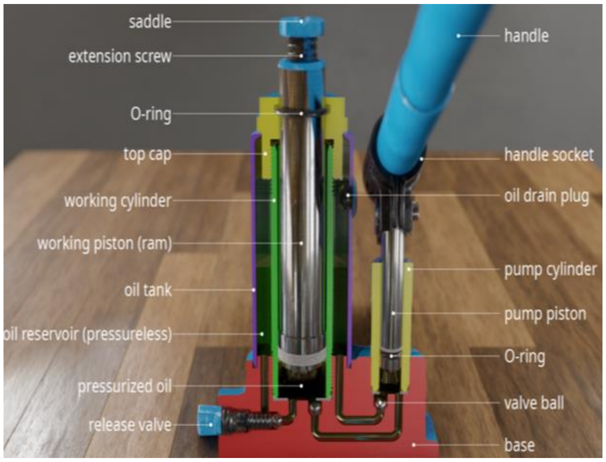


Fig: 1 Hydraulic Jack System

II. LITERATURE SURVEY

2.1 Literature Review

"Hydraulic Jack System Installed in Footpath for Reducing Traffic in Case of Emergency, Automatic Street Light Control System Based on LDR ForMinimize the Electricity Consumption"

Published in:- International Journal of Engineering Research and Technology
Authors :- Ms. Nida Aafreen Aslam Khan & Ms. Komal Sunil Pise

During our study we have conclude that the hydraulic jack system in footpath with less area of construction is very innovative idea in construction world and importantly there is no need to construct any special type of construction to installation of hydraulic jack system which will helps to reduce construction cost, it will also save the cost of land. this system helps during emergency such as road accident, traffic jam. One more concept we have introduce, automatic street light control system based on LDR (light dependent resistor) which is very useful to minimize the consumption or wastage of electricity because LDR system is totally automatically controlling system and it is also less costly as compare to other street light control system.

In future when we will construct any new road so we can think about installation of hydraulic jack system in footpath and introduce as new concept of two in one uses of footpath, within less land requirement. It will also create a great impact of our country in new construction technology world.

"Design and fabrication of Hydraulic Jack system for four wheelers"
Published in :- International Research Journal of Engineering and Technology (IRJET)
Authors :- Aditya Masiwal, Aman Kanungo, Ishan Rawlley, Devendra Jha, Ashutosh Singh, Dhruv Kumar, Ram Jatan Yadav

This concept will not only save the effort of a person but will also save one's precious time under critical circumstances and will eliminate the need of carrying a conventional mechanical jack while travelling. It is a very feasible concept and if worked over cautiously, will become popular very soon. The advantages of the inbuilt hydraulic jack are that this type of system is very useful for ladies and old people since during the problem of puncher of tyres, they can easily change the wheel, the maintenance of vehicle will be very easy and cheap and A single person can go on a long drive without worrying about getting stuck in the way. The disadvantages of this system are that cost will increase slightly and the weight of vehicle will increase slightly. After successful implementation of the above idea in small passenger cars, future developments can be made in design to apply the same in heavy duty automobiles also

"Engineering solutions of traffic safety problems of road transport"
Published in :- ISSSN
Authors :- Marijonas Bogdevicius & Olegas Prentkovskis

A with a hydraulic brake system, a model of road pavement surface, a model of road guardrail, a model of the interaction between motor vehicle wheels and road pavement surface and a model of the interaction between a motor vehicle and a road guardrail) is presented.

Taking into consideration the presented general mathematical model and computer aided test results it is possible to investigate various road transport traffic situations as well as to investigate various transport traffic safety problems, for example what type and where road guardrail shall be mounted, what curvature ray of the road shall be selected so that the motor vehicle would not drive off the road carriageway, which driver caused an accident etc.

The presented general mathematical model is developed for road accidents experts to investigate accidents on the roads, roads designers to investigate existing road sections and to design road sections, other experts and designers for the identification of motor vehicle characteristics when it interacts with road guardrails, for the identification of motor vehicle braking characteristics, for the investigation of any failure of a hydraulic brake system by changing the boundary conditions (fluid pressure in any point of pipeline, motion of pistons, air quantity etc.)

"Development and Evaluation of a Control System for Regional Traffic Management"
Published in :- Hindawi Publishing Corporation
Authors :- John L. McLin and William T. Scherer

Empirical testing of the control system shows that it may improve traffic conditions during nonrecurrent incidents. The algorithm was also able to demonstrate that it can operate as a true automated control system including incident detection, congestion management, and knowing when to terminate control actions. Results indicate that the system is more beneficial during incidents of longer duration, and in addition, the effectiveness of the algorithm is a function of the incident location and network topology. The level of driver compliance can also greatly affect system performance, especially for more severe incidents.

Analysis of the simulation results indicates that the control system can be improved in several areas. First, the progression parameters determined by SYNCHRO need to be included in simulation testing so that the control system can be evaluated more thoroughly. Second, the need for additional feedback response during traffic incidents was identified because of the danger in queue growth, which can block diversion passages. Third, adding incident duration as a feature of each case in the case base and populating the case base with incidents of different durations may lead to better control management actions. Finally, the traffic flow model can be made more accurate by improving the modelling of queuing phenomenon during traffic incidents or investigating other traffic models (e.g., mesoscopic simulation) to be used as the evaluation function within the GA.

It is important to assess the transferability of the control method presented here to larger traffic networks. The development of signal timing plans for each subnetwork is independent of each other, and therefore this component of the control system is quite scalable. Results show that the GA is able to converge quite rapidly to the best selection of timing plan for a specific incident scenario. For a larger network, the number of decision variables will increase substantially; however, GASis quite amenable to parallel processing and this may reduce the time required to find the best control solution.

One of the tenets of CBR is that similar problems are solved by similar solutions. Under this assumption, a case base with a moderately sized, yet diverse, case base can be applied effectively for a large number of incident scenarios. Furthermore, there exists the potential for finding the best solution for individual incidents on an ad hoc manner (i.e., real time) in those situations where no case in the case base is similar enough. In such circumstances, the current network state could be used as input into the traffic flow model along with a parallel implementation of the GA to determine the best traffic management actions in a reasonable time window.

Perhaps the largest obstacle to implementation may be the institutional barriers which exist and prevent the implementation of regional traffic control. As traffic performance in metropolitan areas continues to degrade, these barriers will likely fall in response to the need to improve traffic conditions.

“Intelligent Traffic Control System”

Published in :-International Journal of Scientific and Research Publications.

Authors :- Mrs. Vidya Bhilawade, Dr. L. K. Ragha

Green wave system was used to provide clearance to any emergency vehicle by turning all the red lights to green on the path of the emergency vehicle, the biggest disadvantage of green waves is that, when the wave is disturbed, the disturbance can cause traffic problems that can be exacerbated by the synchronization. In such cases, the queue of vehicles in a green wave grows in size until it becomes too large and some of the vehicles cannot reach the green lights in time and must stop. This is called over-saturation. The disadvantage of RFID based traffic control is that it does not discuss what methods are used for communication between the emergency vehicle and the traffic signal controller.In RFID and GPS based automatic lane clearance system for ambulance, it needs all the information about the starting point, end point of the travel. It may not work, if the ambulance needs to take another route for some reasons or if the starting point is not known in advance.

“Techniques for Smart Traffic Control: An In-depth Review”

Published in :- International Journal of Computer Applications Technology and Research

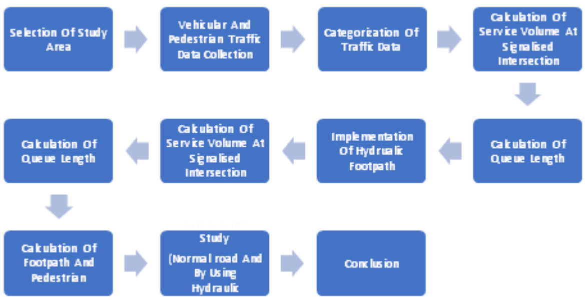
Authors :- Roxanne Hawi, George Okeyo & Michael Kimwele

As A review on the use of technology to control and manage traffic was presented in this paper. It is observed that the implementation of smart technology in transportation systems has a substantial impact on traffic levels. While the static systems provide a simpler method of automatically controlling traffic; they do not have the flexibility needed on most urban junctions which serve non uniform traffic from the various approaches/roads. Advancement in AI has further led to the development of intelligent traffic control systems. The main objective of these smart systems is to have the traffic lights mimic the human intelligence thus eliminating the need of having traffic officers control traffic on the roads. These intelligent systems provide a way for the lights to change from red to green based on current traffic conditions. Though these systems provide substantial benefits to management of traffic, FES and ANN are a branch of A.I. that is still an emerging field in IT; hence the implementation of such systems as standalone is still quite costly, especially in the developing countries. Another STCS alternative to using the A.I systems is sensor networks. These networks have gained popularity especially due to the low cost of implementation compared to the A.I based systems. The network is comprised of many sensors that cooperate to monitor and collect data about traffic conditions on the roads. This information is then forwarded to a controller that processes the data into meaningful information. Using an algorithm, the controller is able to make routing decisions based on current traffic conditions. Although smart traffic control systems still have some limitations to what they can achieve intelligently, the future still holds a lot of promise for these systems. Researchers especially in the field of A.I are working hard to find ways to overcome these limitations in order to make them completely efficient. From this paper it is evident that smart systems are the way forward for road traffic control.

2.2 Objectives

a) To study of traffic volume of particular area.
b) To give a path or way to emergency vehicles.
c) To reduce delay due to traffic.

III. RESEARCH METHODOLOGY



3.1Selection of Study Area

To provide hydraulic footpath we have selected such a site where there is a junction of roads where consist footpath by the all sides of road. There are many such intersections in our city from which we have select Manik Bag Junction and Santosh Hall Junction.

Study area:-
Place -Pune
Area- Manik Bag and Santosh Hall Junction

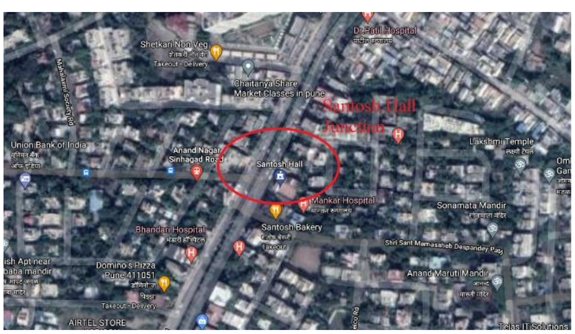


Fig: 2Location of Santosh hall junction.

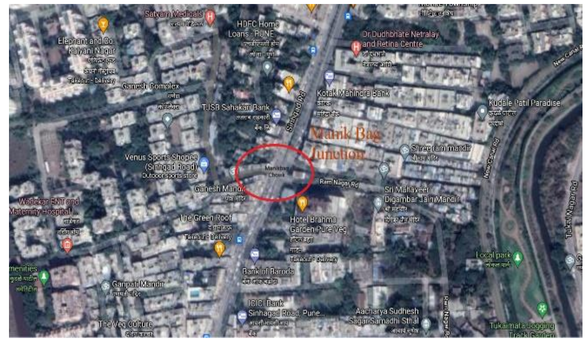


Fig: 3Location of Manik Bag Junction

3.2 Data collection

Time	8.00AM To 9.00AM	9.00AM To 10.00AM	10.00AM To 11.00AM	11.00AM To12.00PM	12.00PM To 1.00PM	4.00PM To 5.00PM	5.00PM To 6.00PM	6.00PM To 7.00PM	7.00PM To 8.00PM	8.00PM To 9.00PM
Vehicles										
Cycle	78	99	94	101	165	37	143	132	134	67
2 wheelers	7498	8487	8441	8046	8321	8014	7577	6725	6889	6545
3 wheelers	878	1146	1321	986	1094	943	1079	1190	1101	1070
4 wheelers	1059	1419	1718	1809	2095	1857	1978	1738	2323	2567
Trucks	26	10	100	126	198	126	78	98	93	107
Tempo	65	15	127	137	148	93	105	100	75	62
Pedestrians	437	527	1716	1926	2015	1986	1903	1325	2010	1431
Hand driven Vehicles	2	3	4	1	3	2	2	3	1	2
Buses	78	93	102	104	137	127	167	155	167	103

Table:1 Traffic Survey Data for various timings on Santosh hall junction.

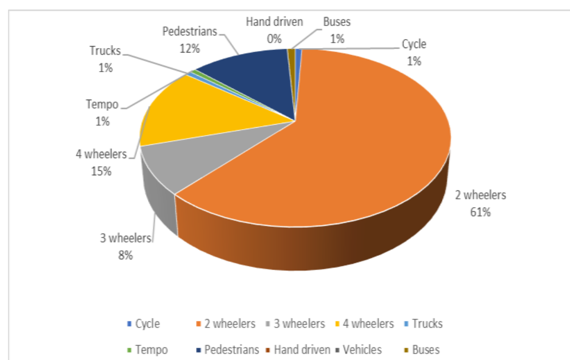


Fig:4 Pie-Chart Showing the percentage of various vehicles.

Time	8.00AM To 9.00AM	9.00AM To 10.00AM	10.00AM To 11.00AM	11.00AM To12.00PM	12.00PM To 1.00PM	4.00PM To 5.00PM	5.00PM To 6.00PM	6.00PM To 7.00PM	7.00PM To 8.00PM	8.00PM To 9.00PM
Vehicles										
Cycle	59	75	71	76	124	28	78	99	101	51
2 wheelers	5624	6365	6331	6035	6241	6011	5683	5044	5167	4909
3 wheelers	659	833	991	738	821	708	810	856	826	803
4 wheelers	759	1065	1289	1357	1572	1393	1484	1304	1743	1926
Trucks	20	8	75	95	149	95	59	74	70	81
Tempo	49	12	96	103	111	70	79	75	57	48
Pedestrians	328	396	1287	1445	1511	1490	1428	994	1507	1074
Hand driven Vehicles	1	2	3	2	2	2	1	2	2	2
Buses	67	91	97	99	126	121	163	149	157	96

Table:2 Traffic Survey Data for various timings on Manik Bag junction.

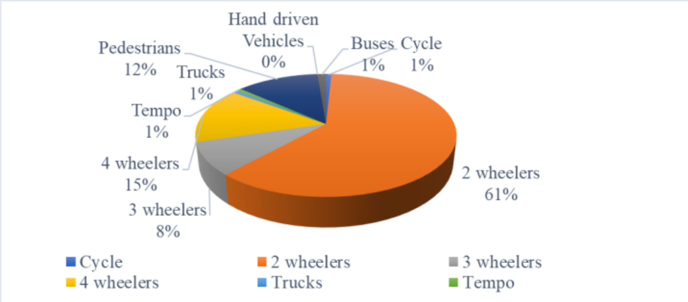


Fig: 5 Pie-Chart Showing the percentage of various vehicles.

3.2 Calculations

1. At Santosh Hall Junction

<u>1.1 CALCULATION OF CURRENT ROAD:</u>
<u>Calculation for service volume at signalized intersection:</u>

Service volume at 7m width of road
Width of road = 7m
Hourly Volume = 14176 v/hr.
Peak Hour Factor (PHF)= V/ (4 x V60) = 54220/ (4 x 14176) = 0.96
PHF = 0.96
G/C Ratio = 25/100 = 0.25 ………… (Effective green time / Cycle length Ratio)
Adjustment Factor = 1.25
Therefore,
Service Volume = Vehicle volume per hour X Adjustment factor X Peak Hour Factor (PHF) X G/C Ratio
= 14176 x 1.25 x 0.96 x 0.25
= 4252 v/hr.

<u>Calculation for Queue length:</u>

Formulas for Queue Length:

- $Q = t_Q \times Q_m / 2c$
- $Q_m = V \times r / 3600$
- $t_Q = (C - C_R) \times t / C – V$

where, V = Mean arrival rate (veh/hr)
r = Effective Red time (s)
Q = Average Queue length
Q_m = Maximum queue length (veh)
C_R = Mean service rate (veh/hr)
C = Mean service volume (veh/hr)
c = Cycle length (sec)
t_Q = Time duration of queue (sec)
t = Effective red time (sec)

- Service Volume = 4252 VPH
- Arrival Rate = 4246 VPH
- Service Rate = 4067 VPH

$t_Q = (C - C_R) \times t / (C – V)$
= (4252 – 4067) X 0.021 / 4252
= 198 sec.
$Q_m = V \times r / 3600$
= 4246 x 60 / 3600
= 71 veh.
$Q = t_Q \times Q_m / 2c$
= 198 x 71 / (2 x 100)
= 71 veh.

<u>1.2 IMPLEMENTATION OF HYDRAULIC FOOTPATH:</u>
<u>Calculation for service volume after implementing hydraulic footpath at signalized intersection:</u>

Service volume at 8.5m width of road
Width of road = 8.5m
Hourly Volume = 16033 v/hr.
Peak Hour Factor (PHF)= V/ (4 x V60) = 70253/ (4 x 16033) = 1.09
PHF = 1.09
G/C Ratio = 25/100 = 0.25 ………… (Effective green time / Cycle length Ratio)
Adjustment Factor = 1.25
Therefore,
Service Volume = Vehicle volume per hour X Adjustment factor X Peak Hour Factor (PHF) X G/C Ratio
= 16033 x 1.25 x 1.09 x 0.25
= 5461 v/hr.

<u>Calculation for Queue length:</u>

Formulas for Queue Length:

- $Q = t_Q \times Q_m / 2c$
- $Q = V \times r / 3600$
- $t_Q = (C - C_R) \times t / C – V$

where, V = Mean arrival rate (veh/hr.)
r = Effective Red time (s)
Q = Average Queue length
Q_m = Maximum queue length (veh)
C_R = Mean service rate (veh/hr.)
C = Mean service volume (veh/hr.)
c = Cycle length (sec)
t_Q = Time duration of queue (sec)
t = Effective red time (sec)

- Service Volume = 5461 VPH
- Arrival Rate = 4246 VPH
- Service Rate = 4106 VPH

$t_Q = (C - C_R) \times t / (C – V)$
= (5461 – 5256) X 0.021 / 5461

= 118 sec.

Q_m = V x r / 3600

= 4246 x 60 / 3600

= 71 veh.

Q = t_Q x Q_m / 2c

= 118 x 69 / (2 x 100)

= 41 veh.

1.3 CALCULATION OF FOOTPATH AND PEDESTRIAN:

Data analysis for pedestrian traffic:

- Width of footpath = 1.5m
- Standard width of footpath for urban street = 1.5m … (recommended by IRC table 11.39. ref.47)
- Capacity of footpath in 1.5m width of footpath = 800 P/hr. … (Given in IRC table. ref. 47)
- Therefore, Data analysis for survey is 763 persons are travelled on each footpath ... (data analysis after surveying)

Loading calculation for footpath:

A) For pedestrian:

- Width of footpath = 1.5 m
- Length of footpath = 10 m
- Area of footpath = 15 m^2
- Minimum Average surface required in pedestrian= 0.085 m
- No. of pedestrian in footpath surface = 15/0.085 = 176 No.
- Average weight of presence per head = 60 kg/head … (refer for WHO data analysis)
- Total weight of pedestrian in footpath surface = No. of person's × wt. of person = 176 × 60 = 10560 kg
- 10560 kg per 12m^2 area of footpath surface = 10560/15 = 704 kg/m^2

B) For vehicles:

- Average of all vehicles= 4-wheeler/Passenger/Ambulance
- Dimension of vehicle (Area) = 2.40 m^2 … (ref. from text book)
- Weight of vehicle (kg) = 1200 kg (ref. from text book)
- No. of vehicle = Area of footpath surface / Area of vehicle required = 15/2.40 = 6 No. of vehicles
- Average weight of vehicle includes in passenger =

weight of vehicle + passenger weight × No. of person's = 1200 + 60 × 9 = 1740 kg

Therefore,

weight of vehicle on footpath surface = weight of vehicle × No. of vehicle

= 1740 x 6 = 10440 kg/ 12m^2

=870 kg/m^2

Loading capacity of footpath surface:

- Total weight of vehicle on footpath surface = 870 kg/m2 = 0.0870 kg/cm^2
- Total weight of pedestrian on footpath surface = 704 kg/m2 = 0.0704 kg/cm^2
- Provided the metal sheet on footpath surface

1. Type - Steel metal sheet
2. Tolerance - 6327 kg/cm^2 … (Tensile Strength)
   - 2812 kg/ cm^2… (Yield Strength)

- Provided the hydraulic machine below the footpath which lift footpath up and down:

a) Type: Fixed Displacement Pump

b) Model: F-12

c) Pressure: 6000 PSI = 422 kg/cm^2

d) Speed: 2290 RPM

e) Flow rate: 240 LPM

f) Compacted and Light weight

g) Thermal Shock resistance

2. At Manik Bag Junction

2.1 CALCULATION OF CURRENT ROAD:

Calculation for service volume at signalized intersection:

Service volume at 7m width of road

Width of road = 7m

Hourly Volume = 10657 v/hr.

Peak Hour Factor (PHF)= V/ (4 x V60) = 40765/ (4 x 10657) = 0.96

PHF = 0.96

G/C Ratio = 25/100 = 0.25 …………. (Effective green time / Cycle length Ratio)

Adjustment Factor = 1.25

Therefore,

Service Volume = Vehicle volume per hour X Adjustment factor X Peak Hour Factor (PHF) X G/C Ratio

= 10657 x 1.25 x 0.96 x 0.25

= 3198 v/hr.

Calculation for Queue length:

Formulas for Queue Length:

- Q = t_Q x Q_m / 2c
- Q = V x r / 3600
- t_Q = (C - C_R) x t / C – V

where, V = Mean arrival rate (veh/hr.)

r = Effective Red time (s)

Q = Average Queue length
Q_m = Maximum queue length (veh)
C_R = Mean service rate (veh/hr.)
C = Mean service volume (veh/hr.)
c = Cycle length (sec)
t_Q = Time duration of queue (sec)
t = Effective red time (sec)

- Service Volume = 3198 VPH
- Arrival Rate = 3196 VPH
- Service Rate = 3043 VPH

$t_Q = (C - C_R) \times t / (C – V)$
= (3198 – 3043) X 0.021 / 3198
= 220 sec.
$Q_m = V \times r / 3600$
= 3196 x 60 / 3600
= 54 veh.
$Q = t_Q \times Q_m \times / 2c$
= 220 x 54 / (2 x 100)
= 60 veh.

2.2 IMPLEMENTTION OF HYDRAULIC FOOTPATH:

Calculation for service volume after implementing hydraulic footpath at signalized intersection:
Service volume at 8.5m width of road
Width of road = 8.5m
Hourly Volume = 12046 v/hr.
Peak Hour Factor (PHF)= V/ (4 x V60) = 42154/ (4 x 12046) = 0.87
PHF = 0.87
G/C Ratio = 25/100 = 0.25 …………. (Effective green time / Cycle length Ratio)
Adjustment Factor = 1.25
Therefore,
Service Volume = Vehicle volume per hour X Adjustment factor X Peak Hour Factor (PHF) X G/C Ratio
= 12046 x 1.25 x 0.87 x 0.25
= 3276 v/hr.
Calculation for Queue length:
Formulas for Queue Length:

- $Q = t_Q \times Q_m / 2c$
- $Q = V \times r / 3600$
- $t_Q = (C - C_R) \times t / C – V$

where, V = Mean arrival rate (veh/hr.)
r = Effective Red time (s)
Q = Average Queue length
Q_m = Maximum queue length (veh)
C_R = Mean service rate (veh/hr.)
C = Mean service volume (veh/hr.)
c = Cycle length (sec)
t_Q = Time duration of queue (sec)
t = Effective red time (sec)

- Service Volume = 3276 VPH
- Arrival Rate = 3196 VPH
- Service Rate = 3150 VPH

$t_Q = (C - C_R) \times t / (C – V)$
= (3276 – 3150) X 0.021 / 3276
= 175 sec.
$Q_m = V \times r / 3600$
= 3196 x 60 / 3600
= 54 veh.
$Q = t_Q \times Q_m / 2c$
= 175 x 54 / (2 x 100)
= 48 veh.

2.3 CALCULATION OF FOOTPATH AND PEDESTRIAN:

Data analysis for pedestrian traffic:

- Width of footpath = 1.5m
- Standard width of footpath for urban street = 1.5m … (recommended by IRC table 11.39. ref.47)
- Capacity of footpath in 1.5m width of footpath = 800 P/hr. … (Given in IRC table. ref. 47)
- Therefore, Data analysis for survey is 563 persons are travelled on each footpath ... (data analysis after surveying)

Loading calculation for footpath:

A. For pedestrian:
    - Width of footpath = 1.5 m

- Length of footpath = 10 m
- Area of footpath = 15 m^2
- Minimum Average surface required in pedestrian= 0.085 m
- No. of pedestrian in footpath surface = 15/0.085 = 176 No.
- Average weight of presence per head = 60 kg/head … (refer for WHO data analysis)
- Total weight of pedestrian in footpath surface = No. of person's × wt. of person = 176 × 60 = 10560 kg
- 10560 kg per 12m2 area of footpath surface = 10560/15 = 704 kg/m^2

B. For vehicles:

- Average of all vehicles= 4-wheeler/Passenger/Ambulance
- Dimension of vehicle (Area) = 2.40 m^2 … (ref. from text book)
- Weight of vehicle (kg) = 1200 kg (ref. from text book)

- No. of vehicle = Area of footpath surface / Area of vehicle required = 15/2.40 = 6 No. of vehicles
- Average weight of vehicle includes in passenger =

weight of vehicle + passenger weight × No. of person's = 1200 + 60 × 9 = 1740 kg

Therefore,

weight of vehicle on footpath surface = weight of vehicle × No. of vehicle

= 1740 x 6 = 10440 kg/ 12m^2

=870 kg/m^2

Loading capacity of footpath surface:

- Total weight of vehicle on footpath surface = 870 kg/m^2 = 0.0870 kg/cm^2
- Total weight of pedestrian on footpath surface = 704 kg/m^2 = 0.0704 kg/cm^2
- Provided the metal sheet on footpath surface

1. Type - Steel metal sheet
2. Tolerance - 6327 kg/cm^2 … (Tensile Strength)
 - 2812 kg/ cm^2… (Yield Strength)

- Provided the hydraulic machine below the footpath which lift footpath up and down:

a) Type: Fixed Displacement Pump
b) Model: F-12
c) Pressure: 6000 PSI = 422 kg/cm2
d) Speed: 2290 RPM
e) Flow rate: 240 LPM
f) Compacted and Light weight
g) Thermal Shock resistance

V. RESULT

Traffic analysed at Sinhgad Road on normal footpath and after implementing hydraulic footpath:

Sr. No.	Location	7m Width of Road			8.5m Width of Road			Reduction of Queue Length
		t_Q	Q_m	Q	t_Q	Q_m	Q	%
1.	Santosh Hall Junction	198	71	71	118	71	41	42.25
2.	Manik Bag Junction	220	54	60	175	54	48	22.22

VI. CONCLUSION

The present study is conducted for the hydraulic footpath at signalized intersection, which effective management for high degree of accuracy to be applicable for traffic flow with wider traffic volume from each intersection. A new mechanical concept is discussed to design footpath, which help of hydraulic mechanism in footpath surface at signalized intersection of roads. It finds wide application in road work planning and design. To understand the significant effects by the traffic management at intersection as well as pedestrian noncompliance and pedestrian vehicular interaction this model are developed. The study is conducted on important parameters such as Reduce Queue length, minimize the formation of platoons, increase service rate and provide extra space for the traffic in emergency situation.

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